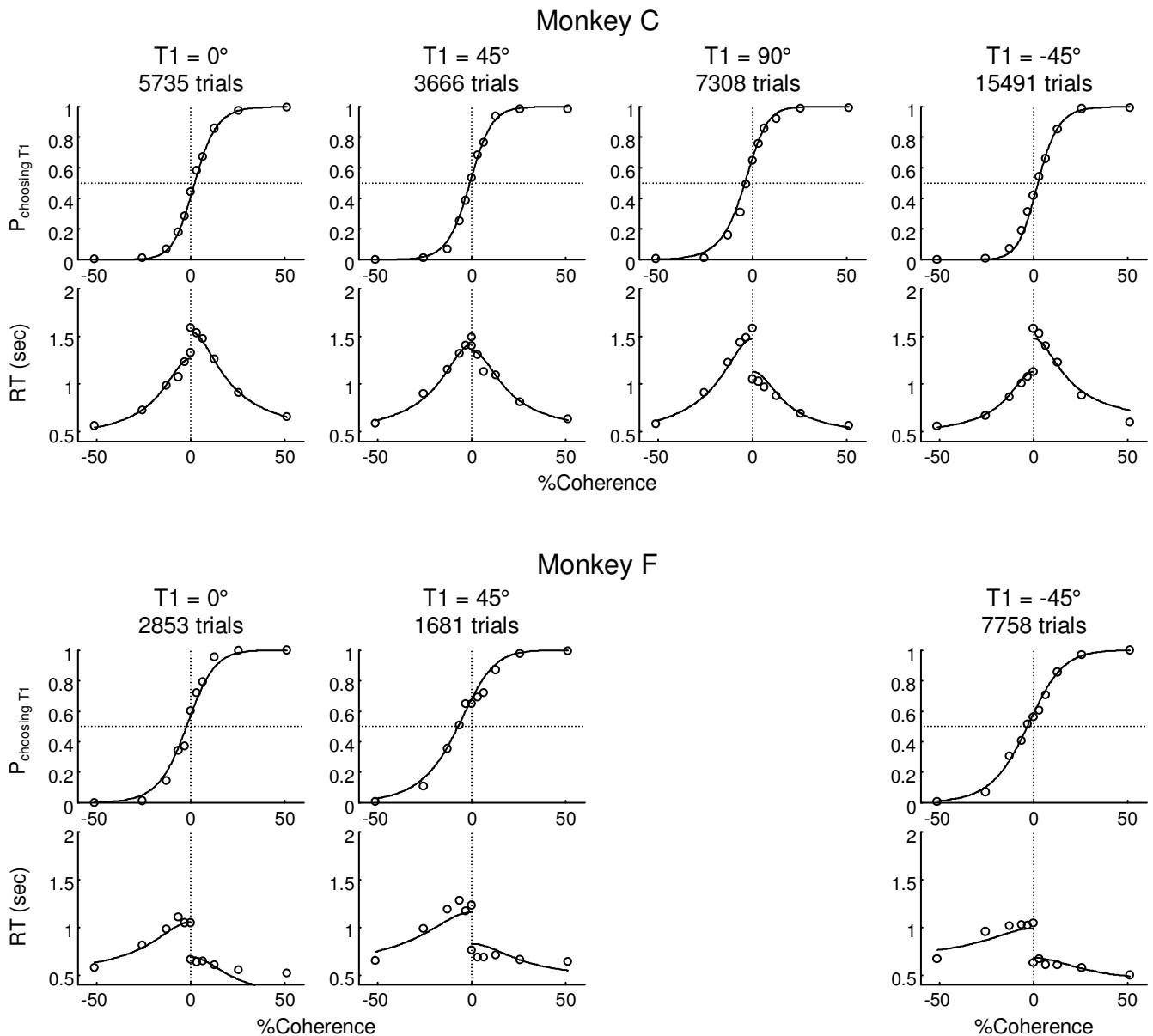
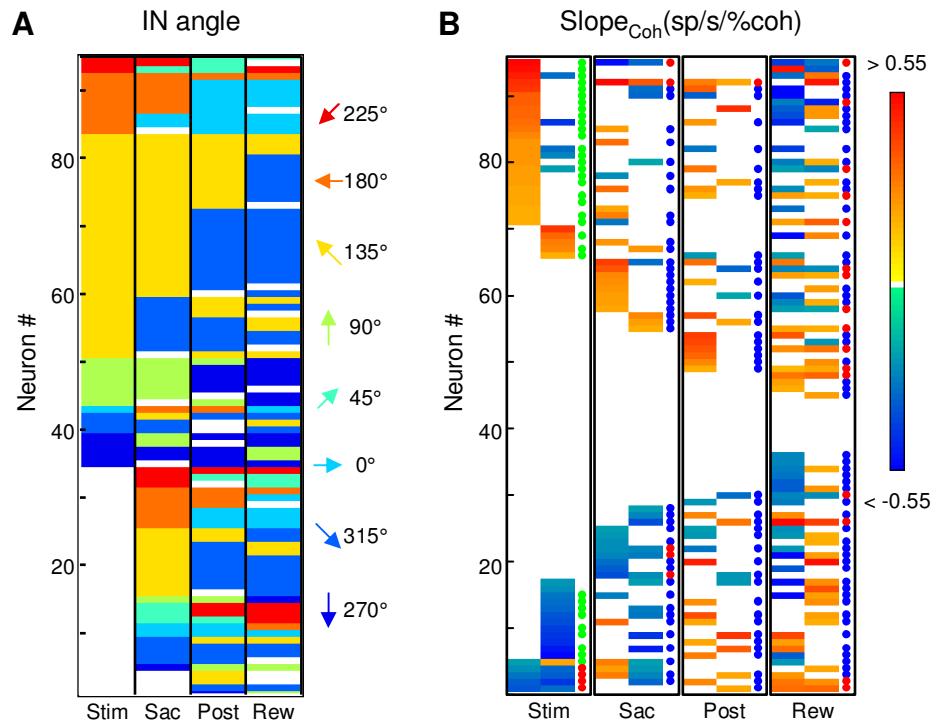


Supplementary Figure 1. Histogram of monkeys' largest eye deviation on each trial between stimulus onset and 100 ms before saccade onset. Mean: 0.49°; std: 0.48°.



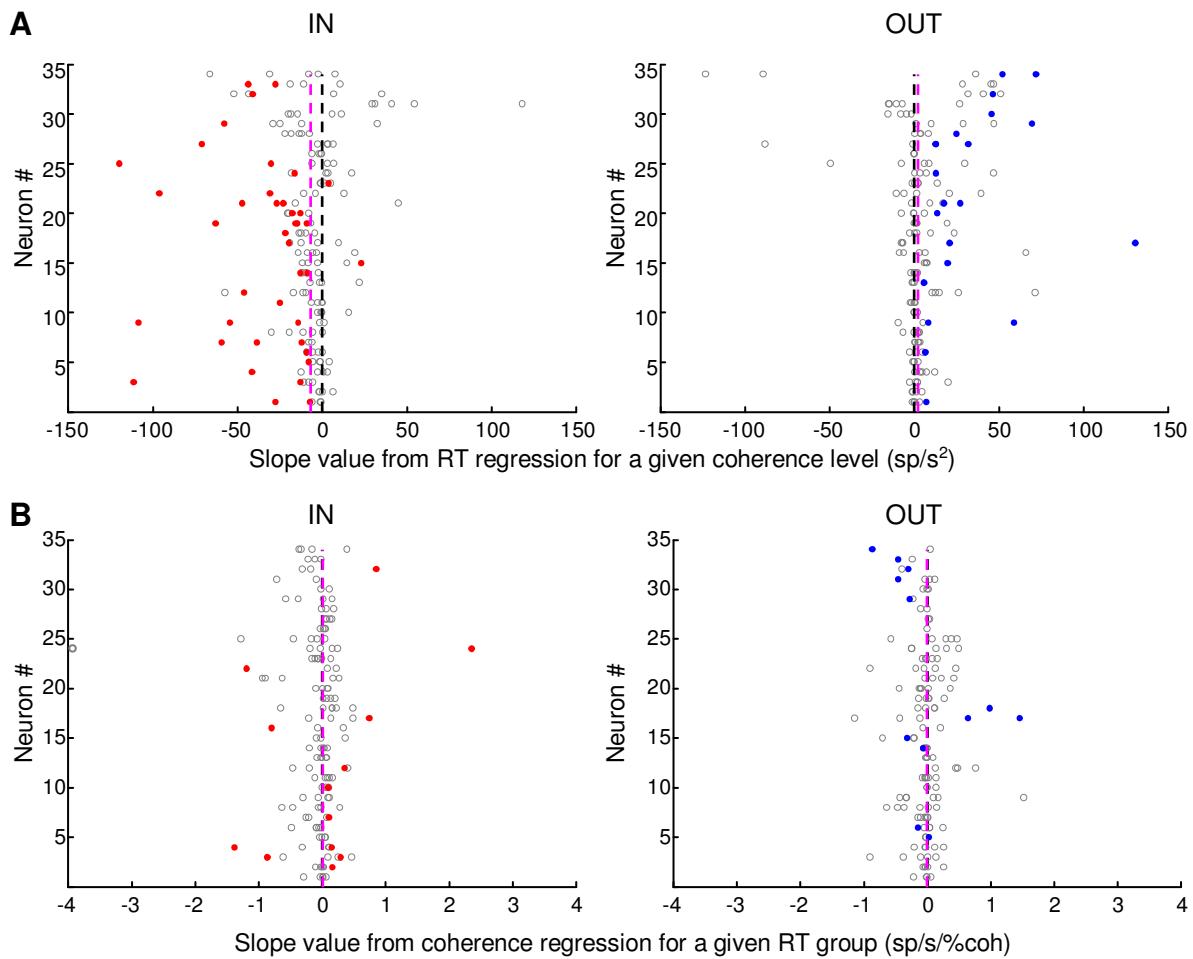
Supplementary Figure 2. Average performance of monkeys along the motion axes tested. Data are aggregated across sessions. The numbers above each set of figures indicate the total number of trials included. Values of fitting parameters and associated measures of threshold, bias, and goodness-of-fit (R^2) are listed in Supplementary Table 1.



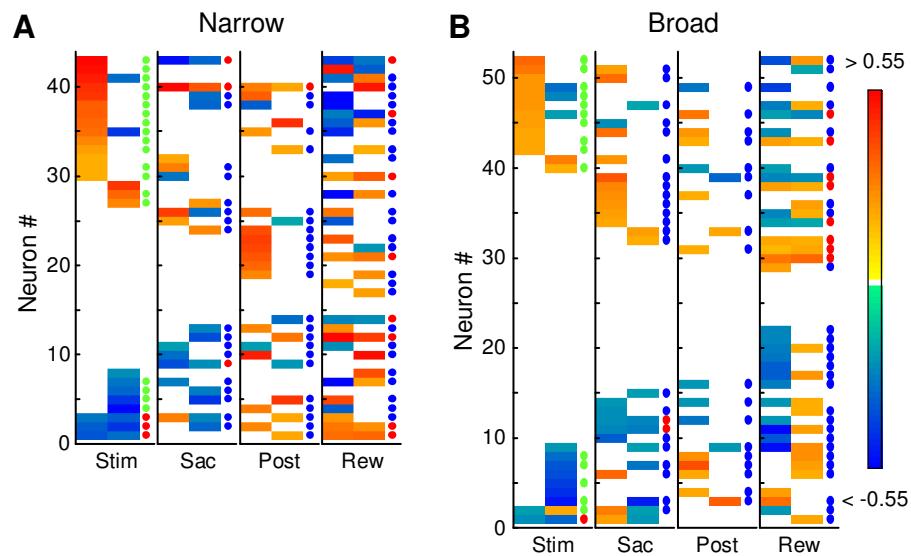
Supplementary Figure 3. Summary of modulation by choice (A) and coherence (B) across epochs in the population of 95 recorded neurons. Each row represents a single neuron across epochs. Activity in different task epochs was tested separately. Neurons are sorted separately in (A) and (B), as described below.

(A) Colors represent the direction preference (i.e., IN target location) of cells showing choice-dependent activity (see color scale to the right). White entries indicate no choice dependence (Wilcoxon rank-sum test, $p \geq 0.05$). Neurons are sorted by their pattern of direction preferences across successive epochs.

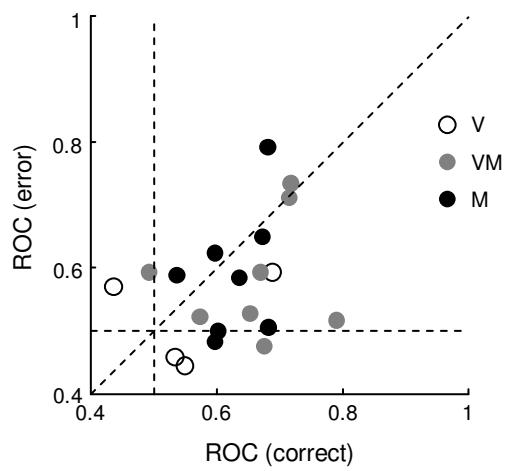
(B) Colors represent the slope of coherence modulation based on a linear regression (see color scale to the right, in units of sp/s/%coh). Positive/negative values imply increasing/decreasing neural responses as a function of coherence. White indicates no significant coherence modulation (F-test, $p \geq 0.05$). For each epoch, the left and right vertical columns represent IN and OUT choices, respectively. Neurons are sorted by slope values of successive columns in descending order. Green, blue, and red circles at the right identify DDM-like activity, choice-dependent decision-trace activity, and decision-trace activity with same-sign coherence modulation for both choices, respectively.



Supplementary Figure 4. Slope values from regression analyses for individual neurons. Each row represents values from a single neuron. For (A), trials were grouped by coherence and choice. Regression with RT as the regressor was performed for each group. For (B), trials were grouped by RT ranges (specified in Table 2) and choice. Regression with coherence as the regressor was performed for each group. Filled circles indicate slope values significantly different from zero (t -test, $p < 0.05$). Magenta dashed lines indicate the median values. In addition to a difference in population median values, also note the prevalence and consistency of significant negative and positive values in (A), for IN and OUT trials, respectively, compared to (B). See Table 2 in the Main Text for detailed statistics.



Supplementary Figure 5. Summary of modulation by motion strength and activity classification in neurons with narrow (C) or broad (D) spikes ($n = 43$ and 52, respectively). Same conventions as Supplementary Fig. 3B.



Supplementary Figure 6. Scatter plot of ROC indices computed using the average firing rate within a 300 ms window beginning at t_{choice} , excluding activity within 100 ms of saccade onset, for 3.2% coherence trials. Only cells categorized as V, VM or M types are shown.

Supplementary Table 1. Statistics of the monkeys' performance, separated by motion axis (T_1 angle). Threshold and bias are estimated from fitted curves. R^2 quantifies the goodness of fit. "Mean" and "Std" correspond to statistics of the distribution of best-fitting values from individual sessions. "All" corresponds to best-fitting values using all trials from all sessions for the given condition, which are used to plot the fitted curves in Supplemental Figure 2.

Monkey C									
T1 angle (°)		Threshold (%coh)	Bias (%coh)	A	B	k	T_{01} (ms)	T_{02} (ms)	R^2
0 (n = 8)	Mean	6.42	2.04	37.42	26.82	0.28	393.63	346.47	0.93
	Std	0.86	1.45	4.46	3.60	0.04	85.55	35.07	0.04
	All	6.46	2.10	38.20	26.58	0.27	385.20	350.05	0.99
45 (n = 7)	Mean	6.82	-1.36	27.93	34.20	0.27	418.90	355.06	0.89
	Std	1.36	0.75	3.30	2.70	0.04	35.52	59.13	0.01
	All	6.61	-1.17	28.64	34.79	0.26	414.29	356.51	0.97
90 (n = 15)	Mean	6.99	-3.78	21.13	41.05	0.31	386.20	325.58	0.90
	Std	2.20	1.43	5.10	5.02	0.09	40.88	109.08	0.07
	All	7.59	-3.90	22.25	39.87	0.25	389.56	319.23	0.95
315 (n = 33)	Mean	6.39	2.80	38.47	23.24	0.30	354.14	370.04	0.89
	Std	0.85	1.63	6.43	4.29	0.04	60.39	57.90	0.07
	All	5.99	1.97	34.25	23.74	0.32	512.29	390.47	0.96
Monkey F									
T1 angle (°)		Threshold (%coh)	Bias (%coh)	A	B	k	T_{01} (ms)	T_{02} (ms)	R^2
0 (n = 10)	Mean	6.77	-4.44	12.20	26.05	0.49	430.58	522.32	0.75
	Std	1.03	1.01	1.90	4.40	0.08	33.64	79.21	0.13
	All	7.74	-2.82	18.35	27.56	0.32	228.84	462.52	0.88
45 (n = 2)	Mean	10.81	-5.37	15.90	27.94	0.25	425.18	569.15	0.78
	Std	1.56	0.68	0.99	1.45	0.05	17.91	5.70	0.05
	All	10.32	-4.86	15.70	26.71	0.26	434.63	588.21	0.85
315 (n = 20)	Mean	10.43	-2.87	14.63	20.00	0.35	376.65	614.28	0.77
	Std	1.70	2.31	4.04	5.48	0.13	61.26	88.53	0.13
	All	10.65	-2.31	15.74	20.01	0.29	379.65	649.79	0.91

Supplementary Table 2. Statistics of the monkeys' performance during recording sessions with DDM-like neurons, separated by motion axis (T_1 angle).

Monkey C									
T1 angle (°)		Threshold (%coh)	Bias (%coh)	A	B	k	T_{01} (ms)	T_{02} (ms)	R^2
0 (n = 3)	Mean	6.85	3.13	38.39	23.18	0.28	363.00	363.62	0.92
	Std	0.81	1.40	4.73	2.09	0.03	50.63	4.10	0.03
45 (n = 2)	Mean	6.72	-1.35	29.70	36.86	0.25	397.40	324.70	0.88
	Std	0.45	0.48	1.69	0.26	0.01	24.95	32.47	0.00
90 (n = 8)	Mean	6.88	-3.83	20.82	40.63	0.31	397.07	379.02	0.91
	Std	2.14	1.63	4.86	4.03	0.08	36.60	111.40	0.05
315 (n = 13)	Mean	6.25	3.63	42.82	21.86	0.30	331.53	390.39	0.91
	Std	0.56	0.94	5.32	3.08	0.04	63.90	38.69	0.04

Monkey F									
T1 angle (°)		Threshold (%coh)	Bias (%coh)	A	B	k	T_{01} (ms)	T_{02} (ms)	R^2
0 (n=1)	Mean	6.08	-3.81	12.42	25.63	0.52	446.02	524.17	0.81
	Std								
315 (n = 7)	Mean	10.12	-2.55	12.93	17.12	0.41	415.31	648.11	0.85
	Std	1.29	2.55	4.08	4.44	0.14	24.86	72.02	0.07

Supplementary Table 3. Average performance grouped by T1. Data plotted in Supplementary Figure 2

	Monkey C			
T1 angle (°)	0	45	90	315
Coherence	P_{T_1}			
-0.512	0.004	0.000	0.005	0.000
-0.256	0.010	0.010	0.010	0.008
-0.128	0.070	0.067	0.160	0.071
-0.064	0.177	0.253	0.307	0.190
-0.032	0.282	0.386	0.492	0.314
0.000	0.442	0.533	0.647	0.420
0.032	0.580	0.685	0.757	0.543
0.064	0.672	0.767	0.857	0.662
0.128	0.857	0.937	0.922	0.853
0.256	0.975	0.984	0.987	0.986
0.512	0.994	0.984	0.992	0.993

	Monkey F			
T1 angle (°)	0	45	315	
Coherence	P_{T_1}			
-0.512	0.000	0.007	0.005	
-0.256	0.013	0.106	0.071	
-0.128	0.143	0.352	0.306	
-0.064	0.342	0.509	0.404	
-0.032	0.371	0.649	0.515	
0.000	0.602	0.649	0.560	
0.032	0.717	0.689	0.606	
0.064	0.791	0.721	0.707	
0.128	0.954	0.869	0.854	
0.256	0.996	0.978	0.968	
0.512	1.000	0.993	1.000	

Coherence	mean RT (ms)				T2 Choice	T1 choice	T2 Choice	T1 choice
	-0.512	561.1	587.5	581.5				
-0.256	724.7	899.6	908.2	669.2				
-0.128	986.3	1153.0	1224.0	866.2				
-0.064	1072.7	1319.3	1435.6	1005.1				
-0.032	1229.9	1405.2	1487.8	1074.2				
0.000	1329.3	1491.6	1583.8	1126.2				
0.000	1586.8	1400.3	1052.8	1579.3				
0.032	1536.6	1305.5	1028.7	1529.9				
0.064	1476.7	1132.0	965.2	1400.8				
0.128	1262.7	1093.5	875.8	1227.1				
0.256	908.3	809.9	691.8	882.9				
0.512	652.9	631.6	564.6	598.8				
0.000	664.7	761.2	630.6					
0.032	636.9	684.6	671.4					
0.064	647.4	684.8	610.3					
0.128	606.3	708.4	606.0					
0.256	554.0	660.2	575.1					
0.512	518.9	639.1	498.3					